From boatanchors@theporch.com Sun Feb 26 18:26:16 1995
Date: Sun, 26 Feb 1995 15:08:27 -0600
Message-Id: <199502252021.OAA16075@zoom.bga.com>
From: Henry van Cleef <vancleef@bga.com>
Subject: Re: 6SJ7 microphonic problem

As Colin Schmutter said
>
> I am using a Webster Electric mono audio amplifier as a utility
> amplifier with an SP 600 receiver.
>
> The amplifier uses a 6SJ7 as the first stage and this stage is
> very microphonic.
>
> The plate load resistor is 100K, screen resistor is 510K and cathode
> resistor to ground is 1K bypassed by a 25 uF capacitor with the B+
> about 250 volts.

Other components in the circuit should be a screen bypass cap of a microfarad or more, and appropriate coupling and grid leak in the follwoing stage. These components seem to be forgotten in some of the references, particularly for detector and noise limiter circuits. It sounds as though the setup is to give frequency response down to about 10 or 20 cps. Lowering the values of the cathode bypass cap, screen bypass cap, and coupling cap will raise the low frequency cutoff. There is a chart in the RCA receiving tube manuals for circuit values for 100 CPS cutoff; otherwise, you will need to use the stuff in an engineering text to analyze the circuit.

Altering the circuit probably won't change the microphonic situation very much.   A different 6SJ7 might make things much better.
>
> Can anyone suggest changes to the component values or an alternative
> tube type to reduce this microphonic condition.

I don't see a low-microphonic version of the 6SJ7 listed in my references, though there may be one.
>
> Performance of the amplifier is otherwise very good.
>

--
****
Hank van Cleef vancleef@bga.com vancleef@tmn.com
****

From boatanchors@theporch.com Sun Feb 26 19:37:46 1995
Date: Sun, 26 Feb 1995 15:14:38 -0600
Message-Id: <F2PF5039.F2PF5050@mail.admin.wisc.edu>

From: TOM.A.ADAMS@mail.admin.wisc.edu
Subject: 816 Substitute

to: boatanchors@theporch.com

Greetings.

What's a good substitute for an 816 mercury rectifier? How about an epoxy "candy bar" with a silicon center? 8-)

I'm currently in a battle with 816 tubes here too; my Globe King uses 'em in the modulator plate supply. That tube is probably the most unreliable of ALL mercs. Just to keep the rig as authentic as possible, I wanna find another pair, but since I also wanna USE the rig until replacement 816s come along, I changed the plate caps on the transformer leads and temporarily plugged in a pair of 3B25 xenon gas rectifier tubes. There are a couple of drawbacks here, as the 3B25 is taller than the 816, and in the Globe King it's a VERY tight fit (ceramic plate caps are resting against the bottom plate of the RF deck). The second drawback is the fact that the 3B25 requires twice the filiment current that an 816 does.

If you've got the space and extra filiment transformer capability, and just plain insist on staying with firebottle rectifiers, I've gotta vote for the 3B25 route. I've never had one backfire or short out from internally manufactured trash (common with 866A and 816), and they don't seem to generate the RF hash that mercs do. In addition, there is no preconditioning treatment needed before putting them into use, and they're not temperature sensitive like all mercury bottles are.

The only other drawback is purely aesthetic; these critters don't glow as brightly as mercury tubes do.

Tom, K9TA

From boatanchors@theporch.com Sun Feb 26 22:26:49 1995
Date: Sun, 26 Feb 1995 15:41:47 -0600
Message-Id: <m0rikzN-0007PnC@beacons.cts.com>
From: Kevin Sanders <kevin@beacons.cts.com>
Subject: RE: Airborne Aerials

[Padgett]
> I suspect that a helium baloon might be more reliable depending on the
> location since operation would not rely on wind (think the poster
> mentioned that this was for competition).

A friend of mine and I tried this, using a large (2.5 ft.) balloon. Whether you use a balloon or a kite, *please* use a monofilament safety line in

addition to the antenna element itself. I can't imagine anything much
worse than a free-flying 200-foot piece of magnet wire just looking for
some high-tension wires to wrap around. We had the opposite problem:
our ballon got up to 200 feet or so and popped. Talk about a mess!
And of course the local poh-leece had to come by while we were filling
up this great big helium balloon at 1:00 AM out in the middle of nowhere ;-)

ObBA: I received a pile o' manuals from W7FG Vintage Manuals and for
the most part they are fine. The HQ-120 manual is missing a few pages,
but the rest are OK. Although I must admit to being a bit concerned
when I found a "Hallicrafters SP-600" manual, it turned out to be okay
too ;-) Thanks for the tip.

```
73,                                ______________
                                 | 0  ___ ___ .. |
    Kevin Sanders, KN6FQ (SDG)   | o, \_/ \_/ .o |      Try Boatanchors
    kevin@beacons.cts.com        | o,, @ o @ ,,o |      For A Real Lift
                                 |_______________|
```

From boatanchors@theporch.com Sun Feb 26 21:07:44 1995
Date: Sun, 26 Feb 1995 15:25:23 -0600
Message-Id: <88CE552.000401146D.uuout@freddy.supernet.ab.ca>
From: shaun.merrigan@freddy.supernet.ab.ca (SHAUN MERRIGAN)
Subject: BA Inventory on PC

Regarding BA inventory on the PC:

I have decided to use a shareware program called Wyndfields, which is a
fairly sophisticated relational database that runs under Windows
(WinOS/2 in my case). I has excellent reporting features and is
extremely flexible. So far, I have about 5 different databases, (which
I can construct links between) for working equipment, spare, scrappers,
documentation, and "wannas". I plan to put my tubes and parts inventory
in also.

With regard to the messages from the BA mailing list: I am using a
program called INFORECALL, which is a free-form database, to store
messages I find interesting and/or useful. The database stands at just
under 500k now. It is very flexible, and has very good searching
(including boolean and "fuzzy") capabilities.

Shaun P. Merrigan
shaun.merrigan@freddy.supernet.ab.ca
merrigan@nyquist.ee.ualberta.ca
2nd Year EE University of Alberta

~ CMPQwk 1.4 #856 ~ Enter any 11-digit prime number to continue

From boatanchors@theporch.com Sun Feb 26 19:37:39 1995
Date: Sun, 26 Feb 1995 15:16:12 -0600
Message-Id: <F2PG2142.F2PG2152@mail.admin.wisc.edu>
From: TOM.A.ADAMS@mail.admin.wisc.edu
Subject: Carl & Jerry

to: boatanchors@theporch.com

Hello Nick.

BOY! Did you EVER hit a major Blast from the Past here!

Carl & Jerry were the prototypes for a whole generation of techno-nerds. When that pair went to college they probably singlehandedly caused a national flood of applications to engineering schools (especially after they encountered an attractive female engineering student / fellow ham).

The stories were kinda hokey at times, but they showed a whole generation of kids that there was a whole lot more to electronics than books, equations, and soldering irons.

When the new issue of Popular Electronics hit the news stand, Carl & Jerry was the FIRST thing that got read (unless, of course, the cover project was a piece of ham or SWL gear!).

I wonder whatever happened to them?

Carl probably got toked out in Haight / Ashbury and went on to become a datahead in Silicon Valley, while Jerry (probably divorced from Jody, the female engineer/ham) survived a tour in 'Nam and is now a laid off engineer from Lockheed who's turned into a survivalist :-(

Carl & Jerry are relics of a simpler time and place, but they're fondly remembered just the same.

73's,

Tom, WPE9GSX (another blast from the
POP'Tronix past...)

From boatanchors@theporch.com Sun Feb 26 18:24:10 1995
Date: Sun, 26 Feb 1995 15:09:56 -0600
Message-Id: <950225155801_32206949@aol.com>
From: Randyc3@aol.com
Subject: Choice HQ180 OR SP600

Let's see, the elections are over, we know where most people stand on O.J., Rush Limbaugh, and Alien abductions of Elvis, sooooo I would like to ask a question that will surely start the group going... I have the option of buying a Hammarlund 180 or SP600. Have room for one or the other. I primarily do SWL, (not so much dx) and want to get back into ham at some point. I enjoy the BA group, and the idea of making/fixing stuff vs. buying it perfect is appealing to me. I also rebuild tube audio stuff, and an occasional chevy small block..

I am sure that a number of you have either or both. I would appreciate pros and cons of each.

Thanks.

PS I have recently cleaned up and aligned an HQ160, so I feel comfortable working on simpler stuff. I have an HP sig gen, a simple counter, and access to a scope if needed. I am located in the San Jose area.

From boatanchors@theporch.com Sun Feb 26 22:21:38 1995
Date: Sun, 26 Feb 1995 15:23:46 -0600
Message-Id: <950226000125_32545781@aol.com>
From: WJoeW@aol.com
Subject: circa 1949 "How to Become..."

When I was a kid, I built a one-tube oscillator/transmitter (6L6, I think) from a plan in an ARRL "How to Become a Radio Amateur", probably published in about 1949, give or take a year.

The "tank" coil was wound of bell wire basket-woven on a circular array of lollipop sticks and the antenna coupling coil, similarly constructed, slid up and down on the sticks to adjust the coupling
(i. e., loading).

I would like to get a copy of that book, or at least the plans for that transmitter.

Can anyone help?

Thanks,

Joe, N5ZYA (originally, and hopefully soon to be again, W5WBR)

From boatanchors@theporch.com Sun Feb 26 22:15:35 1995
Date: Sun, 26 Feb 1995 15:43:55 -0600
Message-Id: <199502261910.LAA05005@netcom15.netcom.com>
From: dgf@netcom.com (David Feldman)

Subject: Did my subscription to boatanchors fail?

I haven't seen any traffic from boatanchors for the last few weeks. If the list is still alive, could someone e-mail me the e-mail address for re-subscription? Thanx! 73 Dave WB0GAZ dgf@netcom.com

From boatanchors@theporch.com Sun Feb 26 18:29:25 1995
Date: Sun, 26 Feb 1995 14:57:29 -0600
Message-Id: <199502251734.LAA06661@lia.bga.com>
From: Henry van Cleef <vancleef@bga.com>
Subject: Re: Electrolytics

As n.mckie@genie.geis.com said
>
> > Changing electrolytic
> > filter capacitors is something like changing oil filters - - -
> > plan to do it.
> > Rhett George - KE4HIH
>
> George, you make a very good point here. My philosophy is that you should plan to replace the electrolytics every 10 or so years for the most reliable operation and best performance. Of course this doesn't always happen but, in my opinion, it is a good plan.
>
> Neil

Hmmm---lessee, how many old electrolytics do I need to replace because they are over ten years old?
The Magnavox 2-chassis console (a 15-tube monster) I rebuilt last summer has 5 dual FP cans, which have been in it since Nov. 1949. It needed 100% capacitor and resistor replacement, but all the electrolytics were good.

1956 Hammarlund HQ-150. It's got 100% original caps (disk ceramics used instead of paper). The electrolytics are fine in that, too.

1957 and 1959 Tek 310 scopes. These are hot-running little monsters. They have an army of FP's in them.   Filtering away "jess fine." Even the seleniums in the older one are rectifying happily as well.

1949 Webster Chicago Wire Recorder. The canned electrolyte jobs are original in that thing, too, and are doing their job just fine. That thing sat in the back of a closet for twenty years, and I did have to reform them by putting some volts through a resistor on them.

And---my prize piece of electronic junk---a 1948 Hickock Signal Generator has a 1948 FP that is happily filtering away.

The RME-45 rebuild did get a new filter cap---mostly because I needed more capacitance for the new power supply, and one was available. The original had low resistance, but "cooking" it for a while with 450 volts through a 100K resistor raised the resistance plenty.

I have had to replace a few in-line electrolytics which were dry as toast, and fresh out of capacitance. But I've replaced more bad mica capacitors over the past year than electrolytics.

I must have at least fifty FP cans with two or three sections in various pieces of equipment which are between 35 and 50 years old. The idea of getting out my soldering iron and replacing all of them tends to depress me, particularly when they are all working happily.
--
****
Hank van Cleef vancleef@bga.com vancleef@tmn.com
****

From boatanchors@theporch.com Sun Feb 26 20:40:27 1995
Date: Sun, 26 Feb 1995 16:57:33 -0600
Message-Id: <MAILQUEUE-101.950226165743.256@novell.physics.umr.edu>
From: "RICHARD SANKOVICH" <SANKO@physics.umr.edu>
Subject: House cleaning

Anybody interested in the following anchors?
     Gonset G-63 ham-band 80m-6m receiver with manual (it works)
     Mobile high voltage supply for Gonset G-76 transceiver
     Heathkit shortwave receiver
     Lafayette Voyager cw/am 80m-6m transmitter

----Rich, K3RGV

From boatanchors@theporch.com Sun Feb 26 19:21:34 1995
Date: Sun, 26 Feb 1995 15:12:53 -0600
Message-Id: <m0riUxk-000CGHC@aupair.cs.athabascau.ca>
From: tech@cs.athabascau.ca (Richard Loken)
Subject: I asked my spies about bobbi's X-Ray generation...

Ross generally knows his science (and his dad was a radiologist) but he doesn't know that Bobbi is female...

>From: rwa (Ross Alexander)
Subject: Re: Does this work? Why?
To: tech@aupair.cs.athabascau.ca (Richard Loken)
Date: Sat, 25 Feb 95 14:17:39 MST

X-Mailer: ELM [version 2.3 PL11]

Richard Loken sez:
> [subject: does this work]

> Subject: Re: Glow, tubes, xrays

> The process is akin to what photography folks call a contact print.
> It's not fast; when we radiographed a fanned out feeler gauge (even the
> thicker sizes were distressingly see-through! It was one of the last
> shots), the exposure time was in excess of fifteen minutes. Shut it off,
> start the film developing for the standard minute, then peel and see how
> it came out. With luck, you'll have a radiograph! If not, try a longer
> exposure. That's all there is to it.

Hell, yes. Notice that he's using glacially long exposures, though. That and the fact that he could see well through the thicker feeler gauge elements tells me that he was generating pretty damn hard (== short wavelength) x-rays, but with low efficiency. He's also being a little bit of an old woman about the safety issue; if it takes 15 minutes to get a print, you'd probably die of old age before you caught even a few roengtens. A bit of a nervous Nellie.

My father taught me that the hardness was controlled by the plate voltage, the intensity was controlled by the plate current. He used from 20 to 40 kV and 100 to 5000 mA, depending on what he wanted a view of. Softer x-rays show fine details in soft tissue (lungs and what-have-you), the hard stuff was for looking at metal screws and plates in dense bone. His exposure times ran in the 1/10s of a second because they used zinc sulphide scintillation screens to transform the x-radiation into visible light, so the films didn't react directly to the xrays (this gives about a 10dB advantage).

I remember (he says magniloquently :) that we had a mod-T spark coil and a Crookes tube (a cold-cathode diode) in my high school physics lab; we also had a zinc sulphide viewing screen. You could look through a textbook or your own arm quite handily (pun) in real time.

Ross

From boatanchors@theporch.com Sun Feb 26 22:04:18 1995
Date: Sun, 26 Feb 1995 15:11:24 -0600
Message-Id: <Pine.LNX.3.91.950225143721.5456A-100000@thelair.zynet.com>
From: johnb@thelair.zynet.com
Subject: My want list....

1) I want a Howard receiver project radio... something complete, and rebuildable for my collection and use.

2) 3&7/8" brown bakelite knob, 1-100 scale over 180 degree arc. Similar to ones in AES Catalog, but bigger. Just need one.

Thanks!
/john

John M. Brewer   wb5oau
johnb@thelair.zynet.com

From boatanchors@theporch.com Sun Feb 26 18:27:58 1995
Date: Sun, 26 Feb 1995 15:07:02 -0600
Message-Id: <199502252015.MAA06287@netcom15.netcom.com>
From: dgf@netcom.com (David Feldman)
Subject: Need EIMAC SK630A sockets for 4CX250B

Looking for EIMAC SK630A sockets for 4CX250B. New or Used. With or without screen bypass caps. Could use a half dozen. Please e-mail if you have any available.

73 Dave WB0GAZ dgf@netcom.com

From boatanchors@theporch.com Sun Feb 26 20:54:29 1995
Date: Sun, 26 Feb 1995 15:27:03 -0600
Message-Id: <88CE545.000401146C.uuout@freddy.supernet.ab.ca>
From: shaun.merrigan@freddy.supernet.ab.ca (SHAUN MERRIGAN)
Subject: Oddball R390A Rectifier R

I am continuing to dig through and attempt to force some order on, my parts inventories....

I found a couple of very interesting 26Z5W substitutes, and I would like to get more information on them:

They came out of an R390A which was purchased for parts, they are both solid state plug-ins for the 26Z5W rectifier tube, one is completely potted, with the following ID: "ED5902 EDI-7838". The other is not potted, and consisted of a couple of 1N3285 diodes. That particular number is not listed in any of my substitution manuals; it is obviously a HV rectifier of some type, any more info such as PRV, VF, Trr, Ifsm,etc.

Shaun P. Merrigan
shaun.merrigan@freddy.supernet.ab.ca
merrigan@nyquist.ee.ualberta.ca
2nd Year EE University of Alberta

~ CMPQwk 1.4 #856 ~ Thesaurus: ancient reptile with an excellent vocabulary.

From boatanchors@theporch.com Sun Feb 26 19:45:35 1995
Date: Sun, 26 Feb 1995 15:20:10 -0600
Message-Id: <MAILQUEUE-101.950225225609.384@vilas.uwex.edu>
From: "Terry O'Laughlin" <OLAUGHLIN@vilas.uwex.edu>
Subject: Stuff For Sale/Trade

My good friend Jack Meyers of Portland, OR acquired a quantity of Heathkit, military and ham gear for which he has no use. He's a retired guy without a car or e-mail but he can ship Parcel Post or UPS.

Please contact him directly!

He wants to obtain a nice BC-348, SX-71 or RME-69 and is open to trades.

Heathkit:

SB-630	Station Console	$75.00
HD-1250	Grid Dipper	55.00
IM-3127	Decade Cap Box	20.00
HN-31	Antenna Resistor (RF Dummy Load)	15.00
HM-2102	Wattmeter/SWR	30.00
IM-17	VOM	17.00
IG-72	Audio Generator	35.00
IP-18	Regulated Supply (1-15VDC/500mA)	17.00
HW-29A	Sixer	35.00
HD-16	Code Practice Oscillator	7.00
IT-27	Transistor/Diode Checker	5.00
IT-18	In-Circuit Transistor Checker	20.00
GD-121	Intercom, Master Station	21.00
GD-131	Intercom, Remote Station (4 units)	25.00 or $6.25 each

Military:

TS-173/UR	90-180 mHz Signal Generator	75.00

CLB-60007	Capacitance/Resistance Bridge .	75.00
BC-639	100-160mHz w/ pwr supply	75.00
R-466/UC	Receiver, Carrier Telegraph for Teletype	50.00

Miscellaneous:

Zenith Transoceanic (needs alignment, cosmetically bad)	$50.00
E.F. Johnson Antenna Coupler (uses plug-in coils, none available, has large 492pF @ 4,000V variable caps)	40.00
Ameco TX-62 6 and 2 meter AM transmitter	75.00

You can reach him at:

Jack Meyers
2656 N. Halleck
Portland, OR 97217
503-283-0821

73s   Terry O'   WB9GVB

From boatanchors@theporch.com Sun Feb 26 19:26:35 1995
Date: Sun, 26 Feb 1995 15:21:49 -0600
Message-Id: <m0riXp2-0007RsC@beacons.cts.com>
From: Kevin Sanders <kevin@beacons.cts.com>
Subject: Re: Suchadeal and heavy, too!

> Primary: 115VAC with a couple of taps..
> Secondaries: 900 vct @ 250 or 350 ma
>   6.3 VAC
>   5.0 VAC

Do you recall the amperage on the 6.3V secondary?

Kevin KN6FQ

From boatanchors@theporch.com Sun Feb 26 22:55:33 1995
Date: Sun, 26 Feb 1995 15:29:00 -0600
Message-Id: <0098C88CC99547C0.2260363D@mwk.com>
From: "Lee K. Gleason" <gleason@MWK.COM>
Subject: The beel Jar issue about cold cathode X-ray emissions

OK, I've gotten the green light to post this on BA. If you re-redistribute, please honor the author's request to do so as is, intact.

It's interesting reading, but, I lost interest in performing the experiments when he described the need for a personal dosimetry regimen...I'm staying in the fractional kilovolt range in my hacking around with firebottles...

Lee K. Gleason N5ZMR
Control-G Consultants
gleason@mwk.com

the Bell Jar (electronic version)

#2 (October 1994)

This newsletter contains material which has been extracted from the hard-copy newsletter of the same name. Devoted to the vacuum experimenter, the intent of "the Bell Jar" is to broaden interest in vacuum technology through useful discussions of theory and technique, and to present ways in which a variety of apparatus may be assembled using common and inexpensive materials. Information on "the Bell Jar" may be obtained by sending email to the editor, Steve Hansen, at hansen35@delphi.com or by writing to 35 Windsor Dr., Amherst, NH 03031. Please feel free to circulate this electronic version, intact, to others who might be interested in the subject matter. New numbers will be mailed at approx. quarterly intervals. Email subscriptions are free and may be obtained by contacting the editor. Comments, contributions and criticisms are always welcome.

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Notice:

After the posting of the first issue of this newsletter, several people sent me email requesting to be put on the distribution list for subsequent issues. Failing to place the requests in a safe file area, those requests were deleted. Please try again and I will maintain a protected copy of the distribution list.

In this issue:

Old TV tubes are used as cold cathode x-ray emitters in a simple apparatus developed by Bob Templeman. With some beam tubes, the intensity is adequate to make x-ray photographs of objects using standard films.

Summary of the contents of "the Bell Jar" for the 1992, 1993 and 1994 volumes plus a look-ahead to 1995.

****

GENERATING X-RAYS WITH RECEIVING TUBES

This article, which describes the experiments of Bob Templeman of Chicago, IL, is condensed from material originally presented in Volume 3, Numbers 1 & 2 (Winter & Spring 1994) of "the Bell Jar". Full circuit schematics as well as sample radiographs are presented in the original articles.

Introduction: Cold and Hot Cathode X-Ray Tubes

The earliest x-ray tubes were of the cold cathode variety. These tubes, referred to as Crookes or Hittorf tubes, were of the general class of gas tubes since the pressure had to be in the `soft' vacuum range (about 10-3 to 10-4 Torr) to permit the passage of electrons from the cathode to the x-ray producing target in a so-called `dark' discharge. Higher pressures would result in a luminous discharge (as in a neon lamp) with only a small potential drop across the tube. Lower pressures (a `hard' vacuum) would result in no current flow regardless of applied voltage.

The cold cathode tube went out of use shortly after 1910 when W. D. Coolidge introduced a tube with a hot cathode (thermionic) electron emitter. The Coolidge tube, which uses high vacuum (i.e. below 10-5 Torr), has a number of advantages over the gas tube.

With the gas tube, the electron current, at a given voltage, is dependent the voltage across the tube which, in turn, can vary depending upon the degree of vacuum. Furthermore, the degree of vacuum will change over time. This will affect the spectrum (hence the penetrating quality) of the x-ray output as well as the intensity. With a heated cathode in a high vacuum tube, the electron current may be controlled simply by varying the filament temperature. Then, by varying the voltage across the tube, the penetrating power of the x-rays (a function of the x-ray energy) may be varied. Thus, two important parameters may be controlled independently.

Using Receiving Tubes in a Cold Cathode Mode

Bob Templeman has been able to use conventional vacuum tubes as cold cathode x-ray tubes. He has done most of his work with the 6BK4B, a beam triode used for voltage regulation of high voltage, low current dc power supplies in color and black-and-white television sets. The tube has an octal base and a plate cap. Bob has also tried several other tubes including the 6EN4 (which is very similar to the 6BK4B), 3AT2, 3CZ3A, and 3BW4. He has found that all will emit measurable amounts of x-radiation but only the beam tubes appear to provide sufficient radiation to expose standard films.

Since the tube is operated in a cold cathode mode, the tube's degree of vacuum is quite important. Bob found that about one in eight tubes is able to produce enough radiation to expose his film. One might ask "why not just heat the filament to get an assured, controlled emission of x-rays?" The answer lies in the basic characteristics of a high vacuum diode. A `normal' vacuum diode, such as a rectifier tube, operates in a region where the tube current varies nearly linearly with the voltage drop. Thus, substantial increases in current would be required to produce a voltage drop across the tube significant enough to produce useful levels of x-rays. For normal tubes, the current would be well in excess of the tube's power rating. Normal operation for a rectifier tube is moderate to high current with a low voltage drop.

What is good for rectifiers is not good for x-ray tubes. In the case of the x-ray tube, the tube is operated in the upper part of the characteristic curve, the 'saturation' region. In this mode, the voltage can be increased with little increase of electron current. Getting the right balance between current and voltage is part of each tube's design. Also, as noted before, varying the filament temperature (e.g. by means of varying the filament voltage) allows the intensity of the tube's output to be adjusted. For each filament temperature, there is a different current vs. voltage characteristic.

The High Voltage Power Supply

Bob uses a TV flyback driven voltage multiplier to power his tubes. This is a fairly common implementation using a pair of general purpose NPN transistors to drive a 10 turn primary which is added to a stock flyback.

The multiplier is of the cascade (Cockcroft-Walton) type. A modular tripler scavenged from a TV set can be used as these can usually be pushed to about 40 kV without failing. A better alternative is to make the multiplier from scratch using discrete diodes and ceramic disk capacitors. The diodes should be rated at 20 kV. A good value for the capacitors would be 0.001 mF at 15 kV.

As the flyback circuit will provide about 10 kV into the multiplier, six stages are required to boost the voltage to a maximum of 60 kV.

The multiplier can be assembled on a piece of bare perf board with good separation between the components. To avoid excessive leakage or arcing, immerse the whole multiplier assembly in mineral oil. A rectangular plastic food storage dish makes a good container for this assembly.

A means of measuring the high voltage output is essential. A resistive divider is appropriate for this application. However, standard components are not suitable for high voltages, low current measurements. A good circuit for measuring the output voltage is a potted TV focus divider (RCA SK series or equivalent) which contains the necessary high voltage/high value resistors. The only additional components needed are one external resistor and a standard high impedance dc meter.

When testing the completed multiplier, avoid the temptation to draw sparks from the output. This will only stress the components and lead to premature failure.

Producing X-Rays

When all is set with the high voltage circuitry and several candidate tubes are in hand, it is time to try generating some x-rays. First, make sure that you have an operating x-ray monitor. This will be needed for checking tubes for output as well as for checking the effectiveness of the shielding. Bob uses a simple Geiger counter circuit which is provided as a kit from Electronic Goldmine (P.O. Box 5408, Scottsdale, AZ 85261). This kit, #C6430, which has an audio output, currently lists for $59.95.

Bob notes that the tubes tend to operate better when the normal cathode is positive, probably because of the slightly higher impedance in this configuration. As this tube element is smaller, the image tends to be a bit sharper. Still, receiving tubes are relatively diffuse emitters of x-rays and the images will be slightly fuzzy.

X-rays are nothing to be treated casually. Bob surrounds his tubes with 2 to 4 inches of lead. (At 60 kV, 1/16 inch of lead is the absolute minimum.) Maintaining a dosimetry program is advisable and some suggestions are provided later in the article. Finally, the safest practice is to operate the tube from a remote location.

Arc-over is a problem at the voltages Bob has been using. Encasing the tubes in wax was tried but found to be only partially effective. Bob's prize 6EN4, the best emitter of x-rays, was destroyed in spite of this encapsulation. Immersing the tubes in mineral oil appears to be more effective. (Watch your druggist's face when you purchase the several bottles of mineral oil which will be needed for insulation of the tube and multiplier!)

Even operating in a cold cathode mode, the current through these tubes at 40 to 60 kV is enough to cause heating. Furthermore, as the tube elements warm up, the cathode begins to emit electrons thermionically. This leads to increasing dissipation, lowered potential, and a shift of the x-ray emission toward the soft, less penetrating, region of the spectrum.

Bob supplied a number of radiographs which were printed with the original article. These showed the internal circuitry of several potted modules as well as the internal structure of a 308 Winchester rifle shell.

The best radiographs taken to date have used Agfapan 400 sheet film. Typical exposures were 30 minutes with the tube about 8.5 inches from the film plane. With a negative bias of 40 kV applied to the plate cap, the tubes draw about 20 microamps.

Bob has been investigating the sensitivities of various phosphors to the x-rays emitted from his tubes. He had no luck with the phosphor salvaged from a fluorescent light tube but he did get a faint fluorescence from the phosphor scraped from the face of a broken color picture tube. The brightness was about comparable to that from a piece of standard medical rare earth phosphor x-ray intensifier screen.

Dosimetry

Any person who regularly works with any combination of high voltage and vacuum should maintain a dosimetry program.

Landauer (2 Science Road, Glenwood, IL 60425-1586, (708) 755-7000) provides film and thermoluminescent (TLD) dosimeters as part of their service. These are provided as either wearable badges or as room monitors. To sign up for the service you select a monitoring frequency (weekly, monthly, quarterly) and pay a small set-up fee plus a year's payment in advance. Before the end of each monitoring period, you receive a new badge. At the end of each period you send in the current badge and within 5 days you receive a report giving dosage for the period plus cumulative dosage. For a TLD dosimeter sensitive to x-ray, gamma, and beta radiation with a quarterly schedule, the cost is under $100 for a year.

Another approach to dosimetry and one which gives a continuous record is a Geiger counter provided by Aware Electronics (P.O. Box 4299, Wilmington, DE 19807, (302) 655-3800). Their RM-60 is a small monitor which interfaces directly to an IBM compatible computer via a phone type cable to the serial or printer port. A dedicated PC is not required as the software gathers the data and stores it to disk even while the computer is running other applications. The software displays the data in a scrolling bar chart format with date and time for each bar. Also provided is the cumulative average dosage. Cost for the RM-60 package is about $150. Aware's catalog also describes several other radiation monitoring items.

Further Reading

Using standard vacuum tubes to produce x-rays is nothing new. C. L. Stong's "Scientific American Book of Projects for the Amateur Scientist" (Simon and Schuster, 1960) has a chapter describing Harry Simons' impressive experiments using antique 01 tubes driven by a homebuilt Oudin coil. Mr. Simons also fabricated a variety of his own tubes, simple bulbs with a sealed-in molybdenum cathode with a magnesium target. The latter was deposited on the inside of the bulb, opposite the cathode, and was capacitively coupled to the Oudin coil by means of a layer of aluminum foil which was wrapped on the outside of the bulb. Simons evacuated his tubes to 0.1 mTorr before sealing.

A large number of books are available which deal with the physics of x-rays, x-ray production, radiographic techniques, and safety. Before proceeding too far with experimentation with x-rays, please visit your local library to obtain further background information, particularly with regard to safety issues.

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"the Bell Jar": CONTENT SUMMARY FOR 1992-1994; PLANS FOR 1995

1992-Vacuum basics, elements of an amateur's system, conversion of refrigeration and auto a/c compressors to vacuum service, a discharge tube gauge, magnetically driven plasma accelerators demonstrated with a rail gun, history of vacuum units, a mini system for fabricating graded density optical filters, a universal thermocouple gauge controller.

1993-Plasma apparatus developed from microwave ovens, vacuum system operation, a coaxial plasma gun, synthesizing fullerenes, easy fabrication of glass to metal seals, reconfigurable vacuum chambers standard glassware components, a baffle chiller made from a room dehumidifier, exploding wires, units of outgassing, Magdeburg hemispheres made from plastic pipe fittings, production of low temperatures, a homebuilt diffusion pump, principle of the pseudospark electron beam source.

1994-Experiments with x-rays produced by receiving tubes, building a multiplate chamber pseudospark electron beam source, a kit of components for conducting gaseous discharge and electron beam experiments, building a simple cathode ray tube, a De Forest style audion triode, electron optics kits from the 50's and 60's, a simple chilled baffle for small diffusion pumps, an amateur's homemade transmission electron microscope, compression fittings from the sink drain, simple electrical feedthroughs, amateurs rebuild a large vacuum coater for telescope mirror making, original thought experiments in vacuum, a 250 kV impulse transformer, a cheap oil mist filter, simple ways of making electron and ion optics, a radio using the homemade vacuum triode, cleaning procedures for epoxy bonding.

Plans for 1995 (and probably beyond) include simple apparatus for classroom use, simple Pirani and Penning gauges, a windowed vacuum tube for transmitting electron beams into the air, ideas for original research, a shock tube for simulating micrometeorite impacts, the Mather device, a crossed-field tube capable of initiating nuclear reactions, a 1-1/2" diffusion pump, topics in ultra-high vacuum, novel high voltage pulse and dc power supplies, vacuum coating, demonstrating the multipactor (electron multiplication) effect.

From boatanchors@theporch.com Sun Feb 26 22:55:59 1995
Date: Sun, 26 Feb 1995 15:44:43 -0600
Message-Id: <9502261540.ZM9831@eehp04>
From: "Gregory Raven Redi" <ravengre@eehp04.comm.mot.com>
Subject: Three Reasons for Blue Glow from Sylvania

Greetings Boatanchorites_

Here is a little piece of hollow state technology to add to your files.

>From "RADIO TUBE HINTS VOLUME 1" compiled and published by Sylvania Electric Products Copyright 1943. This is a little booklet I bought at a hamfest for 25 cents this weekend.

Many inquiries are received relative to the blue glow which is present in a number of Sylvania tubes. Most of these are based on the misunderstanding of the different types of glow that may be present in a tube. There are three different types of blue haze that may appear while tubes are in operation. They are classed as: Fluorescent glow; Mercury vapor haze; gas.

The fluorescent glow is usually of violet color, and is noticeable around the inside surface of the glass bulb. This glow is a phenomenon caused by electronic bombardment taking place within the tube. This glow changes with then intensity of the signal and may at times become bright brilliant. Fluorescent glow has absolutely no affect on the operation of a receiver. In fact, tubes with this characteristic are particularly good as regards gas content.

Mercury vapor haze is a blue glow which is noticeable between the plate and filament in Types 82 and 83 rectifier tubes. These are the only types of Sylvania receiving tubes in which this type of haze appears. The perfect operation of Types 82 and 83 is dependent upon a mercury vapor which comes from free mercury that has been placed in the bulb during the exhaust period. Therefore this type of blue haze is in no way detrimental to the operation of these tubes.

Gas is a blue haze which is usually confined to the vicinity of the plate and filament structure. Its presence, when of large content, affects the operation of a receiver to the extent that erratic performance is noticeable. Gassy tubes should always be replaced with new tubes.

Testing for the above conditions can be best accomplished by actual operation in the receiver. It is not necessary to test for the blue glow evident in Types 82 and 83, since this is characteristic of these two tubes.

When in doubt as to the blue content of other types of tubes as sure test can be made by using a strong magnet next to the bulb. A gassy tube will not be affected in any way by the presence of the magnet, while the fluorescent glow, which has no affect on the performance of the tube, will shift about as the magnetic field is shifted.*

* Keep that magnet away from exposed plate terminals ! (like on 807s and 1625s)

73, KF5N

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Regards,
Greg Raven
egr002@email.mot.com

From boatanchors@theporch.com Sun Feb 26 19:39:49 1995
Date: Sun, 26 Feb 1995 15:18:27 -0600
Message-Id: <Pine.PCW.3.91.950225154739.7591A-100000@pixiuser>
From: Dave Creek <dcreek@pixi.com>
Subject: Re: Variable Capacitor Cleaning

Also good is crushed walnut or pecan shells. We used to use these to clean the carbon out of jet engines.
Get a catalog from J.C. Whitney in Chicago. They sell handheld guns for cleaning with various particles. Sorry, I cant find their 800 number right now.

Dave Creek, NH6BA
Ewa Beach, HI

On Sat, 25 Feb 1995, SnapRoll Stan wrote:

> Date: Sat, 25 Feb 1995 10:01:04 -0600
> From: SnapRoll Stan <gilstrap@ssd.fsi.com>
> To: Multiple recipients of list <boatanchors@theporch.com>
> Subject: Variable Capacitor Cleaning
>
> In the February issue of ER (page 11) there is a mention of cleaning
> corrosion from the plates of a tuning capacitor by bead-blasting. It

> sounds like a good idea. Has anyone tried this? Got any tips about blasting one's cap this way? I've got a capacitor I ran thru the dishwasher but it only cleaned the corrosion and didn't remove it. Does corrosion add to the dielectric constant, that is, will my capacitor be a different value after cleaning? :-)
>
>
> Stan - WB5LBH
>
>
>
> p.s. BTW, thanks to everyone for all the great info about the McElroy bug.
>
>

From boatanchors@theporch.com Sun Feb 26 21:18:17 1995
Date: Sun, 26 Feb 1995 15:41:03 -0600
Message-Id: <199502261152.DAA13991@ix3.ix.netcom.com>
From: jlockwd@ix.netcom.com (Jim Lockwood)
Subject: Re: Variable Capacitor Cleaning

You wrote:

>
>In the February issue of ER (page 11) there is a mention of cleaning corrosion from the plates of a tuning capacitor by bead-blasting. It sounds like a good idea. Has anyone tried this? Got any tips about

I wouldn't do it unless I had disassembled the capacitor. My concern is that blast media would get into the bearing areas and that it would be impossible to remove all of it.

If you do decide to bead blast this cap or anything, and if you want to do the work yourself, practice on something of little value first. Too much air pressure and you could distort the cap plates or in the worst case blast holes in them.

>blasting one's cap this way? I've got a capacitor I ran thru the dishwasher but it only cleaned the corrosion and didn't remove it.

Running it throught the dishwasher is good. (Be sure to relubricate the bearing areas.) That is great preparation for any other steps in a cleaning process.

Assuming the capacitor plates are aluminum, I'd use a solution of phosphoric acid to attack the corrosion. Be sure to do a thorough water rinse to remove the acid.

> Does
>corrosion add to the dielectric constant,

Probably so.

73,

Jim - km6nk

From boatanchors@theporch.com Sun Feb 26 21:00:07 1995
Date: Sun, 26 Feb 1995 16:49:05 -0600
Message-Id: <950226174946_33034274@aol.com>
From: WJoeW@aol.com
Subject: VHF Fixed-tuned BA receiver

I have a 16 tube VHF fixed-tuned receiver, rack mount, made by Electrotechnic Corp. for the Civil Aeronautics Administration, complete with manual. According to manual, the unit is crystal controller and covers AM from 108 to 152 Mc.Seems to be pretty clean. I will be glad to move it from my garage to yours for $15 plus shipping. All tubes are there (miniature tubes), but no crystal.

Joe, N5ZYA

From boatanchors@theporch.com Sun Feb 26 21:57:38 1995
Date: Sun, 26 Feb 1995 19:24:58 -0600
Message-Id: <9502270105.AA27327@uvs1.orl.mmc.com>
From: padgett@tccslr.dnet.mmc.com (A. Padgett Peterson, P.E. Information Security)
Subject: RE: Zenith Transoceanic

>In reply to A.Padgett's remark about the lack of 1L6's a supplier
>here in the UK sold me a 1R5 (aka DK91) as a substitute. I'm not sure
>whether it is an exact replacement as it causes the T-O to go out of
>alignment, but it is better than a dud 1L6.

(just "Padgett" or, if you must, "The Padgett" - am part Scots 8*)

You mean you can just plug a 1R5 in *and it works* !?!. One other person said that but I found it incrediburgable. According to my RCA book, the 1L6 ties grids 3 & 5 together while the 1R5 ties 2 to 4 and hooks 5 to the filament to boot.

Was figuring it would take major surgery & have been struggling with the oscillator math (they are "pentagrid converters" aka combo oscillator-mixer & IMHO non-trivial when you consider that in the T/O the 1L6 tunes from

540 kc to 18.5 Mc on 1.4v filament-cathodes that are in the middle of the series string). So far my eyes have been crossing every time I hit the grid-that-is-really-a-plate.

Would be wonderful if all it needs is an alignment since the 1R5 is relatively plentiful (and more stable according to the book - in 1959 the 1R5 was recommeded for all new designs while the 1L6 even then was "replacement only") but the theory escapes me. Yout wants to know.

Warmly,
Padgett

From boatanchors@theporch.com Sun Feb 26 22:24:40 1995
Date: Sun, 26 Feb 1995 15:42:38 -0600
Message-Id: <199502261840.MAA08904@uro.theporch.com>
From: "Alyn Scott" <scottie@cafe.glassnet.com>
Subject: Zenith Transoceanic

In reply to A.Padgett's remark about the lack of 1L6's a supplier here in the UK sold me a 1R5 (aka DK91) as a substitute. I'm not sure whether it is an exact replacement as it causes the T-O to go out of alignment, but it is better than a dud 1L6.

A radio amateur who advertises in RadCom (the magazine of the RSGB) was selling DAF91's at one pound each. These will replace the 1S5 diode-pentode. At that bargain price I bought a couple even though I already had one spare!

Some time ago on this list someone mentioned about a book that was being written about the history of Zenith. Can someone remind me what the title and author is?

Thanks.

Alyn Scott G7RSK

From boatanchors@theporch.com Sun Feb 26 22:40:11 1995
Date: Sun, 26 Feb 1995 19:54:35 -0600
Message-Id: <9502270124.AA27359@uvs1.orl.mmc.com>
From: padgett@tccslr.dnet.mmc.com (A. Padgett Peterson, P.E. Information Security)
Subject: RE: Zenith Transoceanic

>Some time ago on this list someone mentioned about a book that was
>being written about the history of Zenith. Can someone remind me what
>the title and author is?

"Zenith TransOceanic - the Royalty of Radio" by Bryant & Cones

ISBN 0-88740-708-0 U$24.95 + U$2.00 s&h (US3.00 to CA) no other foreign listing) to "The Radio Professors" pob 592, Stillwater, OK, 74076 (blatent plug).

Essential reading for the T/O enthusiast even if it concentrates more on the "who" than the "what". Don't look here for schematics (though they will sell you copies from the service manuals) or even particularly in depth model analysis (good on 7G605 and Transistors, sketchy otherwise & they seemed to miss the difference between the six civilian 600 models and the three (four ?) varients of the 5H40 chassis) my impression was that a touch too much reliance was placed on the factory documentation that was a bit errrr, revisionist ?

Bottom line, a wonderful read that would be approved by Zenith - particularly the marketing department - but if you go by the listings in the book almost half of mine do not exist (hopefully we will fix that - have sent five or six pages of notes to the authors already 8*). Further, many of the examples shown in marvelous detail in the full colour plates have had modifications that are not mentioned in the captions so Caveat Y'all.

Warmly,
Padgett

ps the space formerly occupied in my garage by a 1970 Grand Prix has now become the site of an eight foot tuo tiered workbench (one 4x8 3/4" plywood sheet ripped at 35" - stock workbenchs are never deep enough for me, nine 8 foot 2x4s, and a box of drywall screws). Test equipment on the 12.875" top shelf with room for T/Os below and still over two feet of work depth beyond. Storage for nine "sewing machines" underneath. All that's left is the wiring and lighting (incandecent). Weighs slightly less than the GP did.